

IN THE SPECIFICATION:**Marked-up Version of Amended Specification****Page 2, paragraph 1 and 2****BACKGROUND OF THE INVENTION**

The invention relates to a method for the contactless measurement of the thickness of transparent materials and a device for performing the method. The method is particularly suitable for the wall thickness measurement of container glass.

BRIEF DESCRIPTION OF THE BACKGROUND OF THE INVENTION**INCLUDING PRIOR ART**

Devices are already known for the automatic contactless or thickness measurement. (DD 261 832, EP 584673, US 4,902,903, US 3,807,870). These devices employ a laser beam, which is directed onto the object to be measured under a certain angle of incidence.

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It is furthermore disadvantageous in connection with these known devices that the wall thickness measurement value is heavily influenced by the non-parallelity of the wall of the measurement object. The two reflected laser beams are propagated [only then] in parallel only, in case when the reflecting surfaces of the object to be measured are disposed in parallel. In the reflecting surfaces of the object to be measured enclose that wedge angle, then the two reflected beams diverge or converge, whereby the measured value can be falsified to such an extent that it becomes useless.

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A further erroneous influence and result is associated with the tipping between the measurement device and the measured object. It is not always assured in particular with measurements in connection with running production that the object to be measured is exactly positioned. The vertical to the surface at the measurement location can therefore deviate in practical situations by a tipping angle relative to the measurement direction of the measurement device.

Marked-up Version of Amended Specification**Page 5, paragraph 2 and 3****SUMMARY OF THE INVENTION****1. Purposes of the Invention**

It is an object of the present invention to furnish a method and a device for performing the method, which allow to obtain reliable reflexes even at non-ideally smooth surfaces of the measurement object and thereby measurement values, wherein the measurement values are not simultaneously falsified by wedge walls and tippings of the measurement object and which method and device delivers evaluable reflexes on the sensors even in case of heavily curved, wedged walls despite a limited aperture of the receiving optics.

2. Brief Description of the Invention

The object is accomplished according to the present invention in that the light is initially collimated and then focused onto the surface of the object to be measured under an angle of incidence relative to the vertical or normal [of] relative to the surface. The two reflexes of the light, that occur at the front side and at the backside are imaged onto an opto-electronic image resolving sensor. At the same time the light from a second illuminating surface is also initially collimated and in the following focused onto the surface of the object to be measured under an angle of incidence, wherein the angle of incidence corresponds angle of reflection of the reflected beam from the first illuminating surface. The reflexes of the second light beam are imaged onto a second opto-electronic image resolving sensor. The average value of the distances of the respective two reflexes on the opto-electronic image resolving sensors are determined as a measure of the wall thickness in a following controller.

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The essence of the invention comprises [to] image illuminating surfaces onto the surface of the object to be measured. The impingement of the surface of the object to be measured occurs from the most different directions of incidence by employing a diffusely illuminating surface instead of a sharply bundled laser beam. The course of beams out of an illuminating surface, wherein the course of beams is focused on the surface of the container, contains a large bandwidth of light bundles, which impinge onto the container surface from different angles of incidence. This assures that parts of the course of the beams are always reflected back into the receiving optics despite the grained, uneven surface of the object to be measured, even though other bundles out of the beam course are not available based on these surface defects. Thus always two reflexes are generated on the opto-electronic image resolving sensor.

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In the accompanying drawing, in which is shown an embodiment example of the invention:

Fig. 1 is a view of a schematic diagram showing a method and device for measurement of wall thickness of container glass.

DETAILED DESCRIPTION OF THE INVENTION

The illuminating surface 11, which for example is realized by a line shaped light exit opening of a light guide, is followed by lens 12. This lens generates a parallel beam from the diverging beam exiting from the illuminating surface 11, wherein the parallel beam is directed into the objective 14 through the semi permeable mirror 13. The objective 14 focuses the beam onto the surface of the container 1 under an angle of incidence. Two reflexes are reflected back from the surface of the container 1 from the front side and from the inner side of the container. These two reflexes are imaged through the objective 24 and through the semi permeable mirror 23 and further through the lens 25 onto the line sensors 26. The controller 3 is disposed following to the line sensor 26, wherein the controller 3 determines the distance of the reflexes and uses the distance [of] between the reflexes as a base for the further calculation of the wall thickness.

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At the same time the lens 22 is disposed following to the illuminating surface 21, wherein the illuminating surface 21 is again realized by a line shaped light exit opening of a light guide. Again this lens generates a parallel beam from the diverging beam which exits from the light guide 21, wherein the parallel beam is directed to the semi permeable mirror 23 into the objective 24, wherein the objective 24 also focuses the beams under an angle of incidence onto the surface of the container 1. This angle of incidence corresponds to the exit angle of the reflexes from the first illuminating surface 11. Similarly two reflexes derived from the front side 1.1 and from the inner side 1.2 of the container are reflected back from the surface of the container 1. These two reflexes are imaged through the objective 14, through the semi permeable mirror 13 and further through the lens 15 onto the line sensor 16. The line sensor 16 is again connected to the controller 3, wherein the controller 3 also determines the distance [of] between these two reflexes and uses the distance [of] between these two reflexes as a base for the further calculation of the wall thickness. The wall thickness is finally determined by an averaging of the distances [of the reflexes on] determined with the two sensors 16 and 26.

IN THE CLAIMS:

Marked-up version of amended claims

1. (amended) A method [Methods] for contactless measurement of [the] a wall thickness of a transparent object [to be measured] by employing of light sources, lenses, deflection mirrors or deflection prisms, semi permeable mirrors as well as line sensors and a controller, characterized in that [the] light from [the] a first illuminating surface (11) is initially collimated and in the following focused onto [the] a surface of the transparent object [to be measured] (1) [under] with an angle incidence relative to [the] a normal of the surface, wherein [the] two reflexes of light, which reflexes occur at [the] a front side (1.1) and at [the back] an inner side (1.2), are imaged furthermore onto [the] a first opto-electronic image resolving sensor (26) and wherein [the] light from [the] a second illuminating surface (21) is simultaneously also initially collimated and in the following focused in the direction toward the surface of the transparent object [to be measured] (1), wherein the direction toward the surface of the transparent object [to be measured] (1) corresponds to the exit direction of the light from the first illuminating [face] surface (11), and wherein furthermore [the] reflexes of [the second beam] light are imaged onto the second opto-electronic image resolving sensor (16) and wherein the average value of the distances of the respective two reflexes on the two opto-electronic image resolving sensors is evaluated as a measure of the wall thickness in a following disposed controller (3).

2. (amended) Device [or] for contactless measurement of [the] wall thickness of a transparent object [to be measured] employing light sources, lenses, semi permeable mirrors or semi permeable prisms as well as image resolving sensors and a controller, characterized in that [the] a lens (12) is disposed following to [the] a first illuminating surface (11), wherein [the] a semi permeable mirror (13) is disposed behind the lens (12) in such a way that [the] light is reflected into [the] an objective (14) and is further focused onto the [measurement] transparent object (1) and wherein furthermore [the] an objective (24) is disposed such that the objective (24) together with [the] a lens (25) images [the] beams reflected at the transparent object [to be measured] (1) onto [the] a sensor (26) through [the] a semi permeable [mirrors] mirror (23) and wherein [the] a lens (22) is simultaneously coordinated to [the] a

second illuminating [face] surface (21), wherein the semi permeabl mirror (23) is disposed following to the lens (22) in such a way that [the] light from the second illuminating [face] surface (21) is focused also onto the transparent object [to be measured] (1) [the objective (24)], wherein the direction of incidence of [the] light corresponds to the exit direction of light from the first illuminating face and wherein [the] reflexes are imaged onto [the] a sensor (16) through the objective (14), wherein [the] a controller (3) is connected following to the two sensors (16) and (26).

3. (amended) Device according to claim 2, characterized in that the illuminating [faces] surfaces (11) and (21) are light exit openings of light guides.

5. (amended) Device according to claim 2 characterized in that the illuminating [faces] surfaces (11) and (21) are lasers with beam expansion optics.

6. (amended) Device according to claim 2, characterized in that the illuminating [faces] surfaces (11) and (21) are light sources with [the] predisposed slot diaphragms.

7. (new) Device for contactless measurement of wall thickness of container glass of transparent object (1) with a front side (1.1) and an inner side (1.2) comprising

a first illuminating surface (11) and a second illuminating surface (21) for generating diverging light beams;

a first lens (12) and a second lens (22) for generating parallel light beams from the diverging light beams generated by the illuminating surfaces (11) and (21) respectively;

a first semi-permeable mirror (13) a second semi-permeable mirror (23) for selective light beams reflection or transmission;

a first objective (14) and a second objective (24) for focusing and generating parallel light beams;

a first sensor (16) and a second sensor (26);

a third lens (15) and a fourth lens (25) for focusing light beams onto the first sensor (16) and the second sensor (26) respectively;

a controller (3) for averaging values determined by the first sensor (16) and the second sensor (26).

8. (new) A method for performing contactless measurement of a wall thickness of transparent container glass comprising

generating diverging light beams;

generating parallel light beams from the diverging light beams and directing the generated parallel light beams;

focusing the directed parallel light beams onto a transparent object (1) having a front side (1.1) and an inner side (1.2)

reflecting focused parallel light beams from the front side (1.1) and the inner side (1.2);

generating parallel light beams from the diverging light beams reflected by the front side (1.1) and the inner side (1.2);

focusing and obtaining light values of reflected parallel light beams;

analyzing obtained light values and determining a wall thickness of the transparent object (1).

REMARKS

Claims 1 through 6 continue to be in the case.

New claims 7 through 8 are being introduced.

Claim 7 is based on the specification.

Claim 8 is based on the specification.

Claims 1, 2, 3, 5, 6 are being amended.

The Office Action refers to Claim Rejections - 35 USC § 112.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. 4. The claims 1 and 2 are generally narrative and indefinite, failing to conform to current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

5. Claim 1 recites the limitation "the illuminating surface" in lines 5-6. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

6. Claim 1 recites the limitation "the opto-electronic image resolving sensor" in lines 11-12. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

7. Claim 1 recites the limitation "the second illuminating surface" in lines 12-13. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

8. Claim 1 recites the limitation "the illuminating face" in line 18. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

9. Claim 1 recites the limitation "the second beam" in line 19. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

10. Claim 1 recites the limitation "the second opto-electronic image resolving sensor" in lines 19-20. There is insufficient antecedent basis for this limitation in the claim.

11. Claim 1 recites the limitation "the two reflexes of light" in line 9. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

12. In claim 1, with regard to the reference to the front side and the back side (line 10), it is not clear if the applicant is referring to the front and back side of the object (1) being measured.

or, something else. If the applicant is referring to the front and back side of the object (1), the object is shown as a circular figure, and it is not clear which is the front or back of this circular figure/object.

Corrections were made according to the Examiner's remark.

13. Claim 2 recites the limitation "the first illuminating surface" in line 6. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

14. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "the semi-permeable mirror" in line 7. It is not clear which one of the possibly many semi-permeable mirrors the applicant is referring to. Appropriate correction is required.

Corrections were made according to the Examiner's remark.

15. Claim 2 recites the limitation "the objective" in lines 11 and 18-19. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

16. Claim 2 stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "the lens" in line 11. It is not clear which one of the possibly many lenses the applicant is referring to. Appropriate correction is required.

Corrections were made according to the Examiner's remark.

17. Claim 2 recites the limitation "the beams" in line 12. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

18. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "the sensor" in line 13. It is not clear which one of the possibly many sensors the applicant is referring to. Appropriate correction is required.

Corrections were made according to the Examiner's remark.

19. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "the semi-permeable mirror" in line 15-16. It is not clear which one of the possibly many semi-permeable mirrors the applicant is referring to.

Appropriate correction is required.

Corrections were made according to the Examiner's remark.

20. Claim 2 recites the limitation "the second illuminating surface" in line 17. There is insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

21. Claim 2 recites the limitation "the first illuminating face" in line 21 (page 14).

There is

insufficient antecedent basis for this limitation in the claim.

Corrections were made according to the Examiner's remark.

22. Claims 3-6 stands objected to because of they are dependent on rejected base claims.

Corrections were made according to the Examiner's remark.

23. Since independent claims 1 and 2 according to the Office Action are replete with errors as indicated in 1-19 above, the Examiner was unable to conduct any art search in order to evaluate merits of the claims.

Applicant submits that the prior art made of record neither anticipates nor renders obvious the present invention.

Reconsideration of all outstanding rejections is respectfully requested.

All claims as presently submitted are deemed to be in form for allowance and an early notice of allowance is earnestly solicited.

Respectfully submitted,

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